Lesson 2.1 • Proportions

Name _____ Period _____ Date _____

1. Estimate the decimal number equivalent for each fraction. Then use your calculator to find the exact value.

a. $\frac{15}{4}$ **b.** $\frac{8}{5}$ **c.** $\frac{17}{100}$

d. $\frac{11}{16}$ **e.** $\frac{5}{45}$ **f.** $\frac{5}{6}$

g. $\frac{6}{11}$ **h.** $\frac{5}{33}$ **i.** $\frac{7}{111}$

2. This table shows the number of endangered animal species in various categories in the United States in 2004. Write each ratio as a fraction.

Type	Species
Mammals	69
Birds	77
Reptiles	14
Amphibians	11
Fish	71

Type	Species
Snails	21
Clams	62
Crustaceans	18
Insects	35
Arachnids	12

(*ecos.fws.gov/tess_public/TESSBoxscore*)

a. endangered arachnids to endangered crustaceans

b. endangered reptiles to endangered insects

c. endangered birds to endangered amphibians

d. endangered mammals to all endangered species in the list

3. Write each ratio as a fraction. Be sure to include units in both the numerator and the denominator.

a. Jeremy's car will go 400 miles on 12 gallons of gas.

b. In 1988, Florence Griffith-Joyner ran 100 meters in 10.49 seconds.

c. In Monaco in 2000, 32,231 people lived in 1.95 square kilometers.

d. Light travels 186,282 miles in 1 second.

4. Find the value of the unknown number in each proportion.

a. $\frac{m}{2} = \frac{3}{4}$ **b.** $\frac{n}{14} = \frac{4.5}{7}$ **c.** $\frac{3}{4} = \frac{h}{14}$

d. $\frac{8}{7} = \frac{x}{22.4}$ **e.** $\frac{9}{14} = \frac{15.3}{b}$ **f.** $\frac{27}{18} = \frac{6}{y}$

Lesson 2.2 • Capture-Recapture

Name _____ Period _____ Date _____

1. The proportion $\frac{36}{45} = \frac{x}{100}$ asks, "36 is what percent of 45?" Write each proportion as a percent question.

a. $\frac{180}{100} = \frac{n}{36}$

b. $\frac{a}{100} = \frac{27}{4}$

c. $\frac{386}{p} = \frac{712}{100}$

d. $\frac{11}{111} = \frac{t}{100}$

2. Write each question as a proportion, and find the unknown number.

a. 75% of 68 is what number?

b. 120% of 37 is what number?

c. 270 is what percent of 90?

d. What percent of 18 is 0.2?

3. Diana had a large stack of playing cards. She knew that 17 of them were kings. She took a sample of 30 cards and found 4 kings. Approximately how many playing cards did Diana have?

4. Write and solve a proportion for each situation.

a. A candy maker put prizes in 600 bags of candy. He then took a random sample of 125 bags of candy and counted 8 bags with prizes in them. Approximately how many bags of candy did the candy maker have?

b. A candy maker estimated that she had 2500 bags of candy. She had put prizes in 92 of them. She collected a sample in which there were 7 bags of candy with prizes. Approximately how many bags of candy were in the sample the candy maker collected?

Lesson 2.3 • Proportions and Measurement Systems

Name _____ Period _____ Date _____

1. Find the value of n in each proportion.

a. $\frac{2.54 \text{ centimeters}}{1 \text{ inch}} = \frac{n \text{ centimeters}}{12 \text{ inches}}$

b. $\frac{1 \text{ kilometer}}{0.621 \text{ mile}} = \frac{n \text{ kilometers}}{200 \text{ miles}}$

c. $\frac{1 \text{ yard}}{0.914 \text{ meter}} = \frac{140 \text{ yards}}{n \text{ meters}}$

d. $\frac{0.305 \text{ meter}}{1 \text{ foot}} = \frac{200 \text{ meters}}{n \text{ feet}}$

2. Use the conversion factors in the table to make each conversion.

1 inch = 2.54 centimeters
1 foot ≈ 0.305 meter
1 foot = 12 inches
5,280 feet = 1 mile
1 yard = 3 feet

a. 10 inches to centimeters

b. 355.6 centimeters to inches

c. 7392 feet to miles

d. 1 mile to inches

e. 4 miles to meters

f. 100 yards to meters

3. Write a proportion and answer each question below using the conversion factor 1 kilogram ≈ 2.2 pounds.

a. $20 buys 2.5 kilograms of steak. How many pounds of steak will $20 buy?

b. Mr. Ruan weighs 170 pounds. What is his mass in kilograms?

c. Which is heavier, 51 kilograms or 110 pounds?

d. Professional middleweight boxers have a weight of at most 160 pounds, which is a mass of at most _____ kilograms.

4. Olympic track and field records are kept in metric units. Use the conversion factors for Exercises 2 and 3 to answer each question below. (*Encyclopedia Britannica Almanac 2005,* pp. 919–923.)

a. In 2004, Veronica Campbell of Jamaica won the 200-meter run in 22.05 seconds. Her average speed was _____ meters per second, or _____ feet per second. Round answers to the nearest hundredth.

b. In 2004, Christian Olsson of Sweden won the triple jump with a distance of 17.79 meters. How many inches was his jump? Give the answer to the nearest inch.

c. In 2004, Yuriy Bilonog of Ukraine won the 16-pound shot put with a distance of 21.16 meters. How far is this in yards? What was the mass of the shot in kilograms? Round answers to the nearest hundredth.

d. In 2004, Huina Xing of China won the women's 10-kilometer run in a time of 30 minutes 24.36 seconds. How far, to the nearest hundredth, did she run in miles? Note: 1 kilometer = 1000 meters.

e. In 2004, Stefano Baldini of Italy won the marathon (26 miles 385 yards) in 2 hours 10 minutes 55.0 seconds. How far is the marathon in meters? What was his average speed in meters per minute? Round answers to the nearest tenth.

Lesson 2.4 • Direct Variation

Name _____ Period _____ Date _____

1. If x represents distance in feet and y represents distance in meters, then $y = 0.3048x$. Enter this equation into the Y= menu on your calculator. Trace on the graph to find each missing quantity. Round each answer to the nearest tenth.

a. 25 feet = y meters

b. x feet = 4 meters

c. 12.4 feet = y meters

d. x feet = 7 meters

2. If x represents distance in inches and y represents distance in centimeters, then $y = 2.54x$. Enter this equation into your calculator. Trace on the graph of the equation or use the calculator table to find each missing quantity. Round each answer to the nearest tenth.

a. 36 inches = y centimeters

b. x inches = 40 centimeters

c. x inches = 15 centimeters

d. 0.8 inch = y centimeters

3. Describe how to solve each equation for x. Then solve.

a. $18 = 3.2x$

b. $5x = 12\frac{1}{2}\left(3\frac{5}{6}\right)$

c. $\frac{7.4}{x} = \frac{1}{0.3}$

d. $\frac{x}{29} = 8.610$

4. Substitute each given value into the equation $y = 4.2x$ to find the missing value.

a. Find y if $x = 5$.

b. Find y if $x = 8$.

c. Find x if $y = 16.8$.

d. Find x if $y = 1.05$.

e. Find y if $x = \frac{3}{4}$.

f. Find x if $y = \frac{3}{4}$.

5. The equation $d = 27.8t$ shows the direct-variation relationship between the time and maximum legal distance traveled on most two-lane highways in Canada. The variable t represents the time in seconds, and d represents the distance in meters. Use the equation to answer the questions.

a. What distance can a car legally cover in 30 seconds? In 1 hour?

b. What is the shortest amount of time in which a person can legally drive 15 kilometers? (1 km = 1000 m)

c. What is the legal speed limit on most two-lane Canadian highways in meters per second? In kilometers per hour? In miles per hour? (1 mi ≈ 1.6 km)

Lesson 2.5 • Inverse Variation

Name _____ Period _____ Date _____

1. Substitute the given value into the equation $y = \frac{12}{x}$ to find the missing value.

a. Find y if $x = 3$.

b. Find y if $x = 48$.

c. Find y if $x = 1.5$.

d. Find x if $y = 2$.

e. Find x if $y = 36$.

f. Find x if $y = 600$.

2. Two quantities, x and y, are inversely proportional. When $x = 8$, $y = 4$. Find the missing coordinate for each point.

a. $(16, y)$

b. $(x, 40)$

c. $(0.2, y)$

d. $(x, 12.8)$

3. Find five points that satisfy the equation $y = \frac{18}{x}$. Graph these points and the equation to verify that your points are on the graph.

4. The amount of time it takes to travel a given distance is inversely proportional to how fast you travel.

a. Sound travels at about 330 m/s in air. How long would it take sound to travel 80 m?

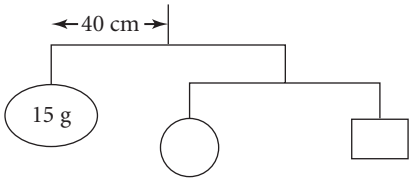
b. How long would it take sound to travel 1 mi, or 1609 m?

c. Sound travels faster through solid matter. How fast does sound travel in ice-cold water if it takes 3 s to travel 4515 m?

5. The mass needed to balance a mobile varies inversely with its distance from the point of suspension. A mass of 15 g balances the mobile when it is hung 40 cm from the suspension string.

a. What mass would be needed if the distance were 30 cm?

b. At what distance could you balance a 10 g mass?



Lesson 2.7 • Evaluating Expressions

Name _____ Period _____ Date _____

1. Use the rules for order of operations to evaluate each expression.

a. $5 + 3 \cdot 2$ **b.** $4 \div 2 - 5$ **c.** $-3 \cdot 4 + 7$ **d.** $6 \cdot (-5) - 8$

e. $-8 + 16 \div 2 + 7$ **f.** $8 \cdot 3 - 12 \div 4$ **g.** $\frac{17 - 5}{3} - 2$ **h.** $\frac{24 + 8}{-2} + 3 \cdot 5$

2. Insert parentheses to make each statement true.

Example: $5 - 2 + 6 = -3$ becomes $5 - (2 + 6) = -3$.

a. $-8 + 3 - 2 + 7 = -2$ **b.** $-8 + 3 - 2 + 7 = -16$

c. $2 - 3 - 4 + 1 = 4$ **d.** $2 - 3 - 4 + 1 = -6$

e. $4 - 5 + 2 - 6 - 11 = 6$ **f.** $4 - 5 + 2 - 6 - 11 = 2$

3. Insert parentheses, operation signs, and exponents to make each statement true.

Example: $-2 \quad 1 \quad = -9$ becomes $-(2^3 + 1) = -9$.

a. $-2 \quad 9 \quad = 1$ **b.** $-6 \quad 3 \quad = 3$

c. $4 \quad 2 \quad 5 \quad = 19$ **d.** $-2 \quad 8 \quad 3 \quad = -8$

e. $12 \quad 3 \quad 1 \quad = -4$ **f.** $3 \quad -2 \quad 7 \quad = 4$

4. Add 6 to a starting number, then multiply by 4, then subtract 7, and finally divide by 3.

a. What is the result when you start with 1? With -7? With $8\frac{1}{2}$?

b. Write an algebraic expression that fits the statement. Use x as the starting number.

c. Use your calculator to find the values of the expression with the starting numbers from 4a.

5. Consider the expression $\frac{4x + 6}{2} - 2x + 14$.

a. Write in words the meaning of the expression.

b. What is the value of the expression if the starting number is 9?

c. Is this expression a number trick? Explain how you know, and if it is, explain why it works.

Lesson 2.8 • Undoing Operations

Name _____ **Period** _____ **Date** _____

1. Evaluate each expression without a calculator. Then check your result with your calculator.

a. $12 - 5$

b. $5 - 12$

c. $-4 + (-6)$

d. $(-6)(-5)$

e. $4(-5) + (-36)\left(-\frac{1}{3}\right)$

f. $\frac{-18}{6} + 5$

g. $\frac{11 - 6(3 - 7)}{-7}$

h. $\frac{-3[10 + (-4)]}{9} - 8.2$

i. $\frac{-6(3 \cdot 4 - 7) - 3}{-11} + 6\left(\frac{2}{3}\right)$

2. Evaluate each expression if $x = 4$.

a. $9 - 2x + 3$

b. $-30 \div 6 + x \cdot -5$

c. $9x \div (9 - 18) - (-10)$

d. $-(5 - 17) \div 3 + -16\left(\frac{1}{x}\right)$

3. For each equation, identify the order of operations. Then work backward through the order of operations to find x.

a. $\frac{x}{5} - 8 = 12$

b. $6x - 7 = 11$

c. $\frac{x - 4}{9} = -1$

d. $-18(x + 0.5) = 27$

4. The Kelvin temperature scale is often used when working with the science of heat. To convert from a Fahrenheit temperature to a Kelvin temperature, subtract 32, then divide by 1.8, and then add 273. The Kelvin scale does not use the word or symbol for degree.

a. Write an equation showing the conversion from degrees Fahrenheit (°F) to Kelvin (K).

b. What is the Kelvin equivalent to normal body temperature, 98.6°F?

c. *Absolute zero,* the complete absence of heat, is 0 K. Use your equation from 4a and the undo procedure to find the Fahrenheit equivalent to absolute zero. Show your steps.

5. For each equation, create an undo table and solve by undoing the order of operations.

a. $\frac{2(x + 1.5)}{5} - 8.2 = -9.1$

b. $9\frac{1}{2} - 5(x - 3) = 18\frac{1}{4}$

c. $\begin{bmatrix} -12 & -6 \\ -15 & -9 \\ -6 & -21 \end{bmatrix}$ **d.** $\begin{bmatrix} -1 & -7 \\ -1 & -1 \\ 4 & -10 \end{bmatrix}$

e. $\begin{bmatrix} -12 & 13 \\ 27 & -22 \end{bmatrix}$ **f.** $\begin{bmatrix} 1 & 2 & 7 \\ 7 & 4 & 2 \end{bmatrix}$

4. $[B] \cdot [A] = [90.17 \quad 92.27]$

It would cost Juanita \$90.17 to buy apples from Pete's Fruits and \$92.27 to buy them from Sal's Produce. Juanita should order her apples from Pete's Fruits. She will save \$2.10.

LESSON 2.1 • Proportions

1. a. 3.75 **b.** 1.6 **c.** 0.17
d. 0.6875 **e.** $0.\overline{1}$ **f.** $0.8\overline{3}$
g. $0.\overline{54}$ **h.** $0.\overline{15}$ **i.** $0.0\overline{63}$

2. a. $\frac{12}{18}$, or $\frac{2}{3}$ **b.** $\frac{14}{35}$, or $\frac{2}{5}$
c. $\frac{77}{11}$, or $\frac{7}{1}$ **d.** $\frac{69}{390}$, or $\frac{23}{130}$

3. a. $\frac{400 \text{ mi}}{12 \text{ gal}}$ **b.** $\frac{100 \text{ m}}{10.49 \text{ s}}$
c. $\frac{32{,}231 \text{ people}}{1.95 \text{ km}^2}$ **d.** $\frac{186{,}282 \text{ mi}}{1 \text{ s}}$

4. a. 1.5 **b.** 9 **c.** 10.5
d. 25.6 **e.** 23.8 **f.** 4

LESSON 2.2 • Capture-Recapture

1. a. What is 180% of 36?
b. 27 is what percent of 4?
c. 712% of what number is 386?
d. 11 is what percent of 111?

2. a. $\frac{x}{68} = \frac{75}{100}$; $x = 51$ **b.** $\frac{x}{37} = \frac{120}{100}$; $x = 44.4$
c. $\frac{x}{100} = \frac{270}{90}$; $x = 300\%$ **d.** $\frac{x}{100} = \frac{0.2}{18}$; $x = 1.\overline{1}\%$

3. 128 cards

4. a. $\frac{8}{125} = \frac{600}{p}$; $p = 9375$ **b.** $\frac{92}{2500} = \frac{7}{b}$; $b = 190$

LESSON 2.3 • Proportions and Measurement Systems

1. a. $n = 30.48$ **b.** $n = 322.06$
c. $n = 127.96$ **d.** $n = 655.74$

2. a. 25.4 cm **b.** 140 in.
c. 1.4 mi **d.** 63,360 in.
e. 6441.6 m **f.** 91.5 m

3. a. $\frac{1 \text{ kg}}{2.2 \text{ lb}} = \frac{2.5 \text{ kg}}{x \text{ lb}}$; $x = 5.5$
b. $\frac{1 \text{ kg}}{2.2 \text{ lb}} = \frac{x \text{ kg}}{170 \text{ lb}}$; $x \approx 77.3$
c. $\frac{1 \text{ kg}}{2.2 \text{ lb}} = \frac{51 \text{ kg}}{x \text{ lb}}$; $x \approx 112.2$. So 51 kg is heavier.
d. $\frac{1 \text{ kg}}{2.2 \text{ lb}} = \frac{x \text{ kg}}{160 \text{ lb}}$; $x \approx 72.7$

4. a. 9.07 m/s; 29.74 ft/s **b.** 700 in.
c. 23.13 yd; 7.27 kg **d.** 6.21 mi
e. 42,222.7 m; 322.5 m/min

LESSON 2.4 • Direct Variation

1. a. $y = 7.6$ **b.** $x = 13.1$ **c.** $y = 3.8$ **d.** $x = 23.0$

2. a. $y = 91.4$ **b.** $x = 15.7$ **c.** $x = 5.9$ **d.** $y = 2.0$

3. a. Divide by 3.2 to undo the multiplication; $x = 5.625$.
b. Divide by 5 to undo the multiplication; $x = 9\frac{7}{12} \approx 9.58$.
c. Change the proportion to $\frac{x}{7.4} = \frac{0.3}{1}$, then multiply by 7.4 to undo the division; $x = 2.22$.
d. Multiply by 29 to undo the division; $x = 249.69$.

4. a. $y = 21$ **b.** $y = 33.6$ **c.** $x = 4$
d. $x = 0.25$ **e.** $y = 3.15$ **f.** $x = \frac{5}{28}$

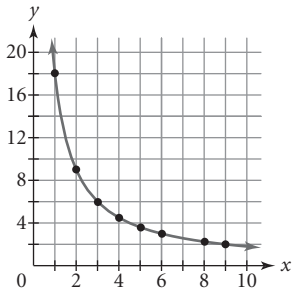
5. a. 834 m; 100,080 m (about 100 km)
b. about 540 s (about 9 min)
c. 27.8 m/s; about 100 km/h; about 62.6 mi/h

LESSON 2.5 • Inverse Variation

1. a. $y = 4$ **b.** $y = 0.25$ **c.** $y = 8$
d. $x = 6$ **e.** $x = 0.\overline{3}$ **f.** $x = 0.02$

2. a. $y = 2$ **b.** $x = 0.8$ **c.** $y = 160$ **d.** $x = 2.5$

3. Possible points: (1, 18), (2, 9), (3, 6), (4, 4.5), (5, 3.6), (6, 3), (8, 2.25), (9, 2)



4. a. about 0.24 s **b.** about 4.88 s **c.** 1505 m/s

5. a. 20 g **b.** 60 cm

LESSON 2.7 • Evaluating Expressions

1. a. 11 **b.** -3 **c.** -5 **d.** -38
e. 7 **f.** 21 **g.** 2 **h.** -1

2. a. $-(8 + 3 - 2) + 7 = -2$
b. $-(8 + 3 - 2 + 7) = -16$
c. $2 - (3 - 4) + 1 = 4$

d. $2 - 3 - (4 + 1) = -6$

e. $4 - 5 + 2 - (6 - 11) = 6$

f. $4 - (5 + 2) - (6 - 11) = 2$

3. Some answers may vary; sample answers are given.

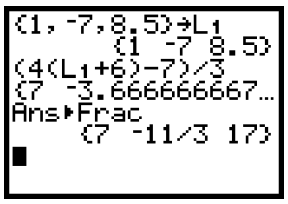
a. $-(2^3 - 9) = 1$ **b.** $-(6 - 3^2) = 3$

c. $4^2 - (2 - 5) = 19$ **d.** $-(2^5 - 8 \cdot 3) = -8$

e. $12 - (3 + 1)^2 = -4$ **f.** $3^2 - (-2 + 7) = 4$

4. a. $7, -\frac{11}{3}, 17$ **b.** $\frac{4(x + 6) - 7}{3}$

c. Calculator technique may vary. A sample answer is:



5. a. Multiply a starting number by 4 and add 6, then divide by 2, then subtract twice the starting number, and finally add 14.

b. 17

c. Yes, it is a number trick. If you pick other starting numbers, the value of the expression is always 17. The trick works because when 4 times the starting number plus 6 is divided by 2, the result is 2 times the starting number plus 3. Subtracting twice the starting number and adding 14 leaves just 3 + 14. It may help to draw a diagram showing the steps.

LESSON 2.8 • Undoing Operations

1. a. 7 **b.** −7 **c.** −10 **d.** 30

e. −8 **f.** 2 **g.** −5 **h.** −10.2

i. 7

2. a. 4 **b.** −25 **c.** 6 **d.** 0

3. a.

		$x = 100$
/ (5)	· (5)	20
− (8)	+ (8)	12

b.

		$x = 3$
· (6)	/ (6)	18
− (7)	+ (7)	11

c.

		$x = -5$
− (4)	+ (4)	−9
/ (9)	· (9)	−1

d.

		$x = -2$
+ (0.5)	− (0.5)	−1.5
· (−18)	/ (−18)	27

4. a. $K = \frac{(F - 32)}{1.8} + 273$ **b.** 310 K

c. $0 = \frac{(F - 32)}{1.8} + 273$

$-273 = \frac{(F - 32)}{1.8}$

$-491.4 = F - 32$

$-459.4 = F$

Absolute zero is −459.4°F.

5. a. Equation: $\frac{2(x + 1.5)}{5} - 8.2 = -9.1$

Description	Undo	Result
Pick x.		− 3.75
+ (1.5)	− (1.5)	− 2.25
· (2)	/ (2)	− 4.5
/ (5)	· (5)	− 0.9
− (8.2)	+ (8.2)	− 9.1

$x = -3.75$

b. Equation: $9\frac{1}{2} - 5(x - 3) = 18\frac{1}{4}$ or $9\frac{1}{2} + (-5)(x - 3) = 18\frac{1}{4}$

Description	Undo	Result
Pick x.		$1\frac{1}{4}$
− (3)	+ (3)	$-1\frac{3}{4}$
· (−5)	/ (−5)	$8\frac{3}{4}$
$+\left(9\frac{1}{2}\right)$	$-\left(9\frac{1}{2}\right)$	$18\frac{1}{4}$

$x = 1\frac{1}{4}$

LESSON 3.1 • Recursive Sequences

1. a. −14

b. −3.5

c. 1

d. −21.5

2. a.

Figure #	Perimeter
1	3
2	5
3	7
4	9
5	11

b. 3 ENTER

Ans + 2 ENTER, ENTER, . . .

c. 21 **d.** Figure 25

3. {−27.4, −18.2, −9, 0.2, 9.4, 18.6}

4. a. Start with 7.8, then apply the rule Ans − 4.2; −30.

b. Start with −9.2, then apply the rule Ans + 2.7; 15.1.

c. Start with 1, then apply the rule Ans · 3; 19,683.

d. Start with 36, then apply the rule Ans ÷ 3; $\frac{4}{2187} \approx 0.001829$.